LEVELL

INSULATION TESTER

TYPE TM14

INSTRUCTION MANUAL

OPERATING INSTRUCTIONS

for

INSULATION TESTER

TYPE TM14

GUARANTEE

We undertake to repair, or replace free of charge, any components that fail within 12 months of the date of purchase of an instrument provided that the instrument is not, in our opinion, modified or misused. Instruments returned by post should be well packed to avoid damage. We recommend the use of two strong cartons, one to fit closely around the instrument and the other large enough to float the small carton in at least 2" thickness of wood wool.

LEVELL ELECTRONICS LIMITED, MOXON STREET, BARNET, HERTS., ENGLAND.

Telephone: 01-449-5028
01-440-8686

We hope you are satisfied with this instrument. May we send you details of the following items that we supply?

INSTRUMENTS

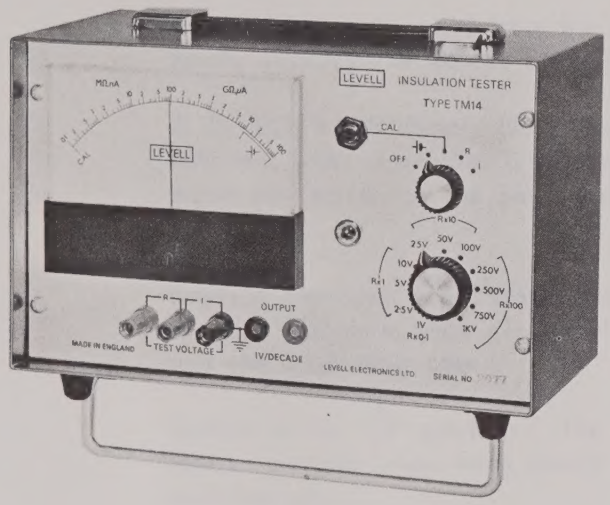
AC AMPLIFIERS
AC MICROVOLTMETERS AND dB METERS
BROADBAND VOLTMETERS
DC MICROVOLTMETERS / NULL DETECTORS
DC MULTIMETERS
DECADE CAPACITANCE BOXES
DECADE RESISTANCE BOXES
FREQUENCY COUNTERS
FUNCTION GENERATORS
INSULATION TESTERS
MULTITESTERS
OSCILLOSCOPES
RC OSCILLATORS - ANALOGUE TUNED
RC OSCILLATORS - DIGITAL TUNED
TRANSISTOR TESTERS

ACCESSORIES

CARRYING CASES
MAINS POWER SUPPLY UNITS
PROBES AND TEST LEADS

LEVELL ELECTRONICS LIMITED
MOXON STREET, BARNET, HERTS., EN5 5SD. ENGLAND.
TELEPHONE: 01-440 8686 AND 01-449 5028.

LEVELL INSULATION TESTER TYPE TM14



- **MEASURES 10kΩ TO 10^{13}Ω.**
- **MEASURES 100pA TO 100μA.**
- **STABILISED VOLTAGES 1V TO 1kV.**
- **RECORDER OUTPUT 1V/DECADE.**
- **POWERED BY INTERNAL 9V BATTERY.**

A logarithmic scale covering 6 decades is used to display either insulation resistance or leakage current at a fixed test voltage. This permits measurements to be made over a wide range without the need for range changes. The instrument is ideally suitable for measurements on insulating materials, semi-conductors, resistors and capacitors.

The current available from the test voltage source is limited to a maximum value of 3mA for safety and capacitors are automatically discharged when the instrument is switched off or to the CAL condition. An indicator lamp glows when the instrument is on as an additional safety feature.

The wide range of the instrument makes it ideal for use in environmental testing and the output may be used to drive a pen recorder or a limit sensor in this application.

RESISTANCE RANGES

10MΩ to 10TΩ(10^{13}Ω) at test voltages of 250V, 500V, 750V and 1kV.
1MΩ to 1TΩ at test voltages of 25V, 50V and 100V.
100kΩ to 100GΩ at test voltages of 2.5V, 5V and 10V.
10kΩ to 10GΩ at test voltage of 1V.
Accuracy of resistance measurement ±15% of indicated value +800Ω on 6 decade logarithmic scale.
Accuracy of test voltages ±3% ±50mV across R terminals at scale centre.
Fall of test voltages <2% at 10μA and <20% at 100μA.
Short circuit current between 500μA and 3mA.

CURRENT RANGE

100pA to 100μA on 6 decade logarithmic scale.
Accuracy of current measurement ±15% of indicated value.
Input voltage drop is approximately 20mV at 100pA, 200mV at 100nA and 400mV at 100μA.
Maximum safe continuous overload is 50mA.

MEASUREMENT TIME

<3s for resistance on all ranges relative to CAL position.
<10s for resistance of 10GΩ across 1μF on 50V to 500V.
Discharge time to 1% is 0.1s per μF on CAL position.

RECORDER OUTPUT

1V per decade ±2% with zero at centre of the range.
Maximum output ±3V. Output resistance 1kΩ.
+3V output corresponds to high current end of current range and to low resistance end of resistance range.

TEMPERATURE

The characteristics specified above are measured at 22°C but only minor divergencies exist from 0°C to 44°C.

CONNECTIONS

Insulated screw terminals which take 4mm plugs at 19mm spacing.

POWER SUPPLY

One type PP9 (or 439) battery or A.C. mains when LEVELL Power Unit is fitted.

SIZE & WEIGHT

180mm x 260mm x 140mm. 3.6kg.
Meter scale length 120mm.

CARRYING CASES

Cases are optional extras. Shoulder straps are detachable and it is possible to use an instrument whilst in a case

OPERATING INSTRUCTIONS FOR LEVELL INSULATION TESTER TYPE TM14

1. Connection of Power Supply

Remove the back panel from the case and connect a 9V battery, Ever Ready Type PP9 or equivalent, by means of the snap fastener provided.

A LEVELL Power Supply Unit Type PU1 may be fitted in place of the batteries when operation is required from an A.C. mains supply. The earth connection on the power unit must be joined to the case of the instrument.

Replace the back panel taking care to ensure that the screws are tight so that there is a good electrical connection between the back panel and the instrument case.

Switch to the ⊣⊢ position. The meter should read between the marked limits, and the neon lamp should glow indicating that the instrument is switched on.

2. Zero Adjustments

There are two adjustments which should be checked before measurements are made with the instrument. The first is the mechanical zero adjustment on the meter which is set to the centre mark on the scale when the instrument is switched off.

The second is the 'CAL' adjustment which is set when the instrument is switched to the 'CAL' position. The instrument should be switched on at least 10 seconds before setting this control. The control should then be rotated to bring the meter to the 'CAL' mark.

3. To Measure Resistance

Turn the instrument to 'CAL' and connect the resistance to be tested between the two terminals marked R. Select the required test voltage, and switch the instrument to R. The resistance read from the meter should be multiplied by the factor of 0.1, 1, 10 or 100 as appropriate to the test voltage used, and indicated on the switch.

The resistance indicated is independent of variations in the test voltage.

4. To Measure Current

The instrument can be used as a wide range current meter when switched to the I position, the terminals marked I being used. The live terminal

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is green and is positive. The multiplier scale marked around the test voltage switch has no effect on the current readings. The test voltages generated by the instrument can be used on the current range. The component is then connected between the terminals marked R and the instrument switched to I, the current through the component being indicated on the meter.

5. To Measure the Leakage of a Capacitor.

The instrument should be switched to 'CAL' and the capacitor connected between the R terminals. Care should be taken with electrolytic capacitors to ensure that the positive end is connected to the red terminal. The appropriate test voltage should be selected, and the instrument switched to R or I depending on whether a resistance or current measurement is required. If the resistance scale is used, the meter reading should be multiplied by the appropriate factor as indicated around the test voltage switch.

When measuring large capacitors, some time will elapse before a steady reading is obtained while the capacitor is being charged.

Switching the instrument back to 'CAL', ⊣⊢, or OFF discharges the capacitor into 22kΩ so the fall to 1% is 0.1s per μF.

WARNING

The high test voltages generated by the instrument are current limited to less than 3mA for safety; however, if a capacitor is connected, a severe shock can be obtained by discharge of the energy stored in the capacitor. Extra care should therefore be taken when testing capacitors at high voltages.

6. Problems arising with long test leads.

The insulation resistance between the wires connecting the R terminals to the component under test can be low enough to give errors when measuring high resistances. Polythene or PTFE insulated test leads are much better than P.V.C. but even these should not be run in long twisted pairs. Errors can also be caused by pick-up of mains voltage if the test leads are long and run near to A.C. mains supply leads. It is therefore recommended that, when long leads are needed, they should be a pair of individual coaxial screened leads with the outer braiding of both joined to the black earth terminal to guard against both leakage and mains pick-up.

7. Recorder Output

The output across the red and black sockets is zero when the meter is at the centre of the scale. The output change is 1 volt per decade up to ± 3V with + 3V corresponding to the high current end of the current range and the low resistance end of the resistance ranges.

The actual value of the output voltage on the I range is $\log_{10}$ (I/100nA) and on the R ranges it is $\log_{10}$ (S x 100MΩ/R) where S is the multiplier indicated on the test voltage switch.

8. Adjustment of the Preset Controls

The layout of the preset controls is given on the diagram at the end of the text.

The preset controls are provided to permit optimum adjustment of the performance of the instrument. These controls are set prior to despatch from the factory when operating from a supply of 8.2V ± 10% at a temperature of 20°C to 25°C. Readjustment of these controls will not normally be required for many months unless the instrument has had a component failure.

Adjustment should be made only in the following order:-

a) SET METER ZERO

The mechanical zero adjustment on the front of the meter should be set to indicate 100MΩ when the instrument is switched to OFF.

b) V ZERO

Connect together the I terminals, and short negative end of 6.8μF Capacitor (base of J12) to earth. Set the preset control on I for the best reading near the scale centre (the control is very fierce).

c) 500V

Connect a standard voltmeter across the red and black terminals with the instrument set at R and 500V. The meter should measure 500V to ± 1% with a current consumption of less than 5μA. Adjust the preset control to obtain exactly 500V output.

d) METER

Connect a standard voltmeter, capable of reading 3V ± 1% with

>1MΩ impedance, across the output, and feed sufficient current into the terminals on the I range to give +3V output. Set the preset control so the meter reads 100μA. Switch to R, and again obtain +3V on the output. The meter should read 0.1MΩ (times R multiplier). Reset the preset control for the least errors on R and I.

e) 100nA

On I range feed in 100nA monitored by a standard current meter that is accurate to within ±2%. Set the preset control for exactly 100nA on the meter.

f) 100μA

As for (e) but with 100μA input. Set the preset control for exactly 100μA on the meter.

g) 100pA

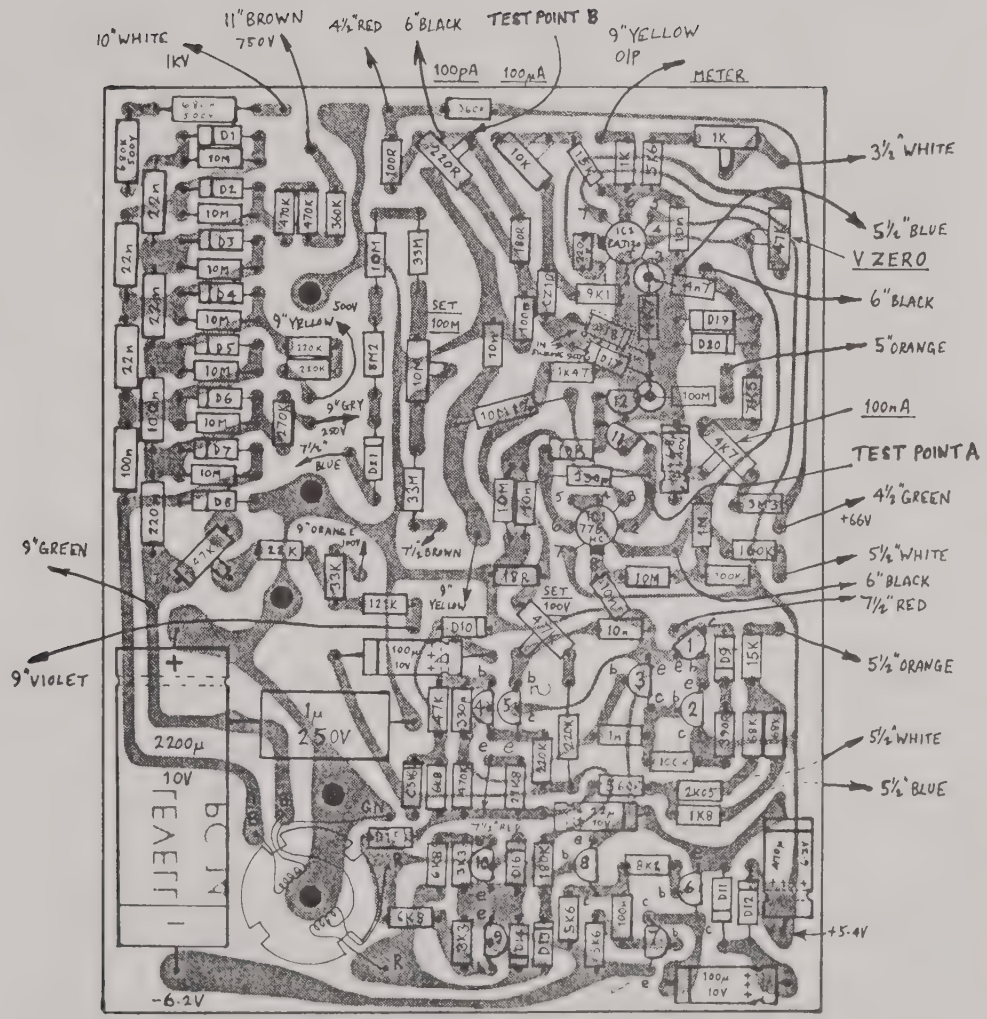
As for (e) but with 100pA input (through 1000MΩ). The 'CAL' control on the front panel should be set so that the meter is precisely on 'CAL'. Switch to 'CAL' and adjust preset control for exactly 100pA on the meter.

h) 100V

Feed in approximately 200mV on I from a variable source of resistance less than 50kΩ so as to bring the meter to its centre point. Set the preset control so the voltages across the R terminals from 1V to 100V are within ±3% ±50mV when measured on a standard voltmeter of input resistance greater than 50MΩ.

i) SET 100MΩ

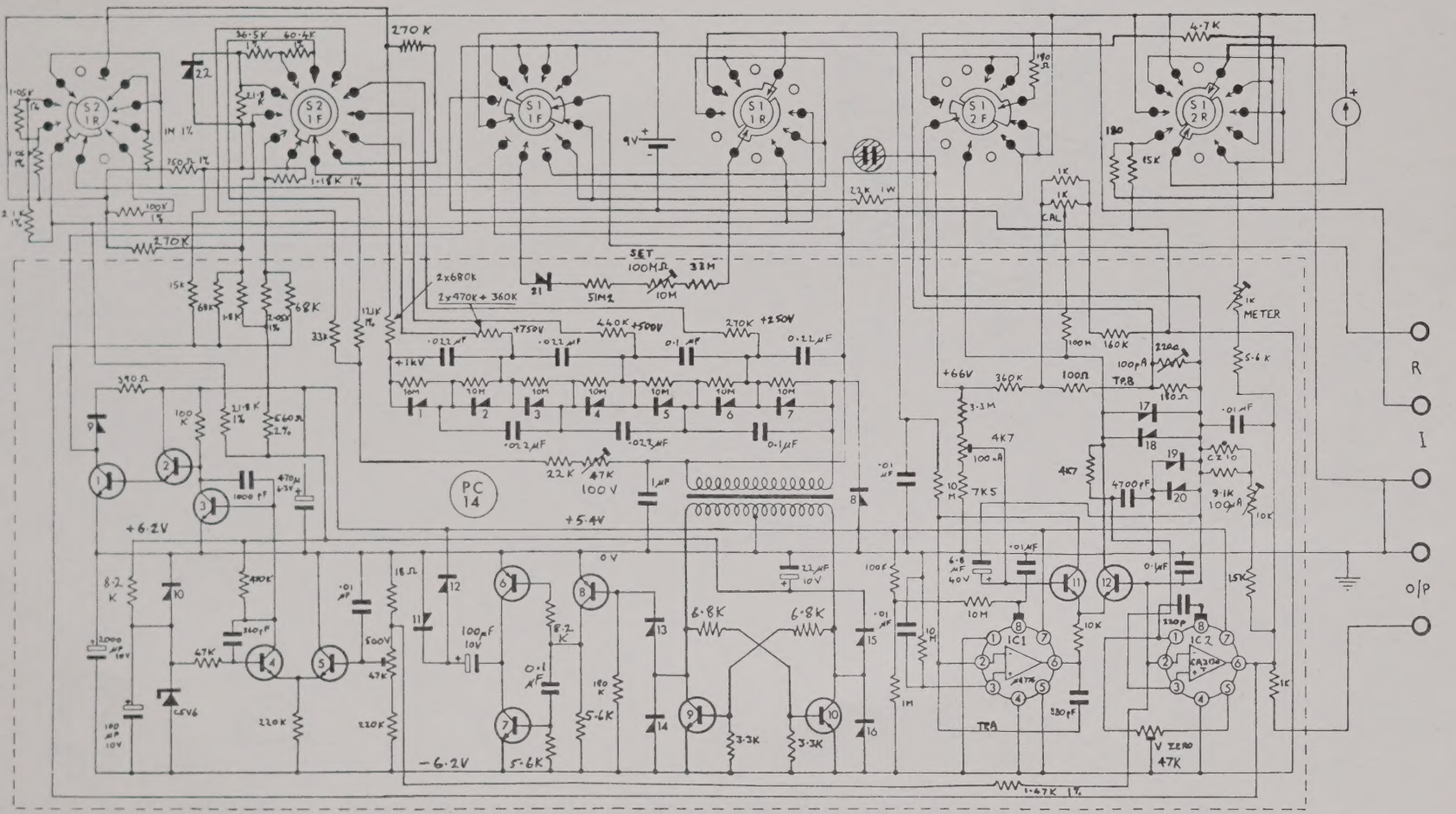
Connect a standard 100MΩ resistance between the red and green terminals. Select the R range and adjust the control for the least errors from 10V to 1KV.



SET 10M PRESET ONLY ON EARLY VERSIONS IN PLACE OF 10M±1%

D1/D8	1N4004	J1	BC337-40
D9,10,13/16,21	1N4148	J2/5,7	ME4102
D11,12	OA47	J6/8	ME0412
D17/20	1S921	J9,10	C1900
		J11,12	BC184LC

COMPONENT SIDE OF TM14 PRINTED CIRCUIT - GF VERSION



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RESISTORS 10Ω - 1MΩ ±5%, >1MΩ ±10%, UNLESS OTHERWISE STATED

ISSUE 6